

# Solar Wind and Motion of Meteoroids

Jozef Klačka

Institute of Astronomy, Faculty for Mathematics and Physics, Comenius University,  
Mlynská dolina, 842 15 Bratislava, Slovak Republic

**Abstract.** The effect of nonradial component of solar wind is discussed from the qualitative point of view. It is shown that the direction of nonradial component is opposite in comparison with the direction used in papers dealing with orbital evolution of meteoroids.

## 1. Introduction

Klačka (1994) has discussed the effect of solar wind particles on the motion of small interplanetary dust particles. He has pointed out that nonradial component of the solar wind has an opposite direction than the direction used in papers of the field of interplanetary matter. He has also tried to obtain some quantitative results following from consideration of the correct nonradial direction.

One of the newest papers dealing with the orbital evolution of meteoroids (Cremonese *et al.* 1997) also takes nonradial direction of solar wind into account. However, this direction is still taken in the incorrect way (see also references in Cremonese *et al.* 1997).

## 2. Nonradial Direction of the Solar Wind – Qualitative Discussion

Using literature on solar physics, Klačka (1994) has pointed out that nonradial component of solar wind brings down the effect of inspiralling interplanetary dust particles toward the Sun generated by the effect of solar electromagnetic radiation (spherical particles: Robertson 1937, see also Klačka 1992 as for the most complete form; nonspherical particles: Klačka 1994, Klačka and Kocifaj 1994). However, according to (Cremonese *et al.* 1997, see also references in this paper) the nonradial component of the solar wind raises the effect of inspiralling interplanetary dust particles toward the Sun generated by the effect of solar electromagnetic radiation.

We can present another argument in favour of the nonradial direction of solar wind used in Klačka (1994). This argument is presented in Figure 3.20 (p. 84) in Hundhausen (1972). The important property of the nonradial component deals in fact that it is a function of distance from the Sun (e. g., Figure 3.21 (p. 87) in Hundhausen (1972)). This fact was not considered in Klačka (1994). However, the dependence on distance is not known, and, thus, no precise calculations can be reliably done. The only thing one can do is to make some other estimates (in comparison to Klačka 1994), using as a motivation

the result presented in Figure 3.21 (Hundhausen 1972, p. 87). Supposing that the nonradial component depends on the heliocentric distance as  $1/r$ , the inspiralling toward the Sun due to the solar electromagnetic radiation will be stopped at several solar radii. This artificial example shows the importance of knowing exact dependence of the nonradial component on the heliocentric distance.

## 3. Conclusion

We have shown that solar wind's real direction of nonradial component is opposite in comparison to that considered in (Cremonese *et al.* 1997, see also references in this paper). Correct consideration of this nonradial component, together with its dependence on heliocentric distance, will help us in our better understanding of the evolution of small particles in solar system (perhaps one of the most interesting concerns the zodiacal cloud).

## References

- Cremonese, G., Fulle, M., Marzari, F., Vanzani, V., 1997, *Astron. Astrophys.* 324, 770  
Hundhausen, A. J., 1972, *Coronal Expansion and Solar Wind*, Springer-Verlag, Berlin-Heidelberg, 238 pp.  
Klačka J., 1992, *Earth, Moon and Planets* 59, 41  
Klačka J., 1994, *Earth, Moon and Planets* 64, 125  
Klačka J., Kocifaj M., 1994, in: *Dynamics and Astrometry of Natural and Artificial Celestial Bodies*, K. Kurzynska, F. Barlier, P. K. Seidelmann and I. Wytrzyśszczak (eds.), *Astronomical Observatory of A. Mickiewicz University, Poznan*, p. 187  
Robertson, H. P., 1937, *MNRAS* 97, 423